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ABSTRACT

This background paper summarizes the design of a faculty early retirement plan at Stanford University. Summary and recommendations indicate: (1) Budgetary stringencies at Stanford require that the faculty size remain essentially fixed. In view of this situation, a properly designed early retirement program should be adopted as a means of increasing the turnover rate of faculty positions. (2) The plan proposed in this report is based on the premise that early retirement should be available as an option to every older faculty member to be requested at his or her own initiative. (3) This retirement income provided by this plan doubles in amount during the individual's final six years of service. Furthermore, final pensions are directly related to salary levels. (4) In designing an early retirement program, special attention should be paid to identifying the group of faculty members who the institution would most like to see avail themselves of this new opportunity. (5) A financial incentive scheme is developed which attempts to abate some of its undesirable features; the effect is to offer a greater supplement to low-salaried than to high-salaried professors for volunteering to withdraw from active service. (6) The proposed plan should be offered to the faculties of all Schools except the School of Medicine with the proviso that participation is to be only by mutual consent of the faculty member and the university. Estimated overall effects of the early retirement program on the numbers, flows, and costs of faculty are included. (Author/MJM)

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AN EARLY RETIREMENT PROGRAM FOR THE STANFORD FACULTY: Report and Recommendations

David S. P. Hopkins

Report No. 72-1

July, 1972

FOREWORD

This paper summarizes research carried out in the Academic Planning Office at Stanford University during the 1971-72 academic year on the design of a faculty early retirement plan. The proposal was presented to the administration in the spring of 1972 and was subsequently approved in principle. While several details remain to be worked out, it now appears likely that a plan having the proposed features will be adopted and offered to the faculty in the fall. Because the Stanford administration is aware of the keen interest in the subject of faculty early retirement at many other institutions, it has approved the distribution of this background paper at this time.

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SUMMARY AND RECOMMENDATIONS

1. Budgetary stringencies at Stanford, as well as at many other universities, require that henceforth the faculty size remain essentially fixed. Now that the faculty has ceased to grow, one finds that the high proportion currently holding tenure positions imposes a severe limitation on the ability of the institution to maintain a steady influx of new people. In view of this situation, a properly designed early retirement program should be adopted as a means of increasing the turnover rate of faculty positions.

2. The usual approach at other institutions has been for the administration to seek out on an ad hoc basis a less productive faculty member to whom a supplementary pension is then offered as encouragement to accept early retirement. The plan proposed in this report, on the other hand, is based on the premise that early retirement should be available as an option to every older faculty member to be requested at his or her own initiative.

3. The TIAA-CREF retirement plan for Stanford faculty members contains strong incentives for its subscribers to remain in active service until they reach mandatory retirement age. In a typical case, the retirement income provided by the plan doubles in amount during the individual's final six years

of service. Furthermore, final pensions are directly related to salary levels, so that low-salaried faculty members generally receive much less than those who have been paid at higher rates during the same period of active service.

4. In designing an early retirement program, special attention should be paid to identifying the group of faculty members who the institution would most like to see avail themselves of this new opportunity. In the case of Stanford, the best candidates for early retirement appear to be those with salaries below the mean for their age group and service times over 10 years.

5. A financial incentive scheme is developed which, when superimposed on the current plan, attempts to abate some of its undesirable features. Specifically, the proposed plan offers a minimum early retirement income that depends on an individual's age and length of service, but not on his salary level. See Table 6 on pages 33 and 34. The effect is to offer a greater supplement to low-salaried than to high-salaried professors for volunteering to withdraw from active service before age 65.

6. According to preliminary estimates of its costs and benefits, the proposed plan should be offered to the faculties of all Schools except the School of Medicine with the proviso that participation is to be only by the mutual consent of a faculty member and the University. Implementation of the

plan should be on a temporary basis, with the University retaining the right to review and revise it after three or four years.

7. The estimated overall effects of the early retirement program on the numbers, flows, and costs of faculty over the period from September 1972 to September 1977 are the following:
   (a) Due to the flow of early retirements, there will be a gain of 45 vacant positions for new faculty over the five-year period. (Table 14, page 55)
   (b) The number in nontenure at the end of the period will be 12 per cent greater, while the ratio of young (below age 55) tenure faculty to old tenure faculty will be 35 per cent greater. (Table 14, page 55)
   (c) Total faculty costs will be about the same whether the early retirement plan is implemented or not. The five-year discounted cost of faculty salaries and retirement benefits including early retirement supplements under the new plan is estimated to be $81,600,000, as compared with $82,048,000 if it is not offered. (Table 19, page 60)

All of these computations assume the total faculty size is held to its present level in each School and specified appointment and promotion policies are used.

I. INTRODUCTION

Many academic institutions -- Stanford among them -- are beginning to discover some unfortunate effects of past hiring and promotion policies under the restrictions of the faculty tenure system. As long as academic programs were growing at a rapid rate there were sufficient openings for new faculty to maintain a proper balance between junior and senior faculty members. With the slowing down of this growth, however, we have observed a disproportionate number appearing in tenure ranks, thus leading to increased instructional costs and less freedom to hire new people. When a campus is no longer able to expand, these problems become even more acute.

Since the number of available new positions is inversely proportional to the average length of service, it is desirable from the standpoints of both the University and the forthcoming generation of young intellectuals to find means to reduce the service times of some of the faculty. One measure that can be employed to achieve this objective over the long run is to reduce the promotion rates from junior faculty ranks into tenure and to fill vacated positions with well-established tenure faculty recruited from other institutions, thereby substituting individuals with service lifetimes of ten to fifteen years for those with lifetimes of twenty to thirty years. Such a practice has been

followed for many years at Harvard, for example, with the result that in today's "steady-state" environment, and despite the fact that most Harvard professors continue to serve beyond age 65, the proportion of faculty in tenure positions continues to be maintained at a reasonable level (under 60% in the School of Arts and Sciences).

This report is concerned with another method for bringing about a reduction in tenure lifetimes, namely the initiation of a program designed to encourage older faculty members to voluntarily withdraw from active service before they reach mandatory retirement age. Since salary savings are likely to accrue from the replacement of a senior faculty member by a junior one, it is widely recognized that an institution desiring to reduce its tenure ratio can afford to offer compensation in the form of supplementary retirement income to an individual who is willing to accept early retirement. There is less agreement, however, on just how much compensation should be offered, and to whom. The plan described in this report is based on the dual assumptions that early retirement should be available as an option to every faculty member and that the incentive to participate should be inversely related to an individual's level of performance. Thus, within the context of a formalized plan, an attempt will be made to induce less productive older members of the faculty into voluntary withdrawal while offering significantly less encouragement to their more productive colleagues.

Although the emphasis thus far has been on concerns of management, a separate, but equally compelling, motivation for this study is based on the concerns of the faculty members themselves. For there has recently been much evidence to indicate that, given adequate financial support, many individuals would like to enter retirement before they reach the mandatory age. This study demonstrates that under current University retirement policies only in the most exceptional case can an individual afford to withdraw early. It is hoped that the proposed plan will enable those who find this option most appealing to actually free themselves from the institution when they would choose to do so.

Given the current state of financial hardship in higher education, it is not surprising that a great many institutions are seizing upon early retirement as a promising means of relieving their budgets from the need to support a high proportion of older faculty members. What is surprising is how little systematic analysis of the problem has been done to date, how rarely it has been asked whether the retirement systems that are presently in existence incorporate incentives that are appropriate to institutional well-being. In most cases in which some action has actually been taken, an ad hoc approach has been used in which an individual faculty member is singled out whose value to the institution is judged to have diminished to a level that is no longer commensurate with his salary. An offer is then made to the individual to supplement his pension fund,

and hence his retirement income, if he will agree to retire before he reaches the mandatory age. The amount of the offer is often determined so as to yield the same retirement income now as the employee anticipates receiving upon mandatory retirement.

If one is willing to concede that the state of affairs that has brought about the current interest in early retirement by universities and their faculty members is likely to prevail for some time in the future, then he must view such ad hoc approaches as providing only marginal solutions to a more widespread problem. A more appropriate response would be to examine the incentive structures of retirement systems as they are presently constituted in an effort to determine whether these systems have been designed with the interests of the institution, as well as of the individual, in mind. If it is concluded that these incentives are not the most desirable from an institutional standpoint, some thought should then be given to developing new structures that are more in line with institutional needs.

Even if a "selected individual" approach should yield significant institutional gains in the short run, there are obvious drawbacks to allowing it to become customary procedure. In the first place, few academic officers should wish to seek out on a regular basis early retirement candidates with whom they must then negotiate a settlement on individual terms. Secondly, there arises the question of how long such a practice can be conducted before

it leads to ill-feeling among the rest of the faculty. After all, it might appear to some persons as though certain others were being rewarded for their lack of efficiency. For both these reasons, it would seem more proper to work from the premise that the initiative should remain with the faculty member to request early retirement under a plan that provides incentives for the least productive to participate.

A recent TIAA-CREF bulletin on "Provisions for Early Retirement" describes the formalized programs that have been implemented at two member institutions. In both cases, early retirement refers to retirement at age 65 instead of 68 or 70, and the bonus involves supplementing an individual's retirement fund so that either the accumulation or the income derived therefrom will approximate its expected final value. In the same bulletin, a formula is proposed that determines the amount of supplemental lifetime income to be offered as a proportion of an individual's final salary. No attempt is made to justify these programs from a cost savings standpoint, nor is it suggested how one might estimate the costs and benefits resulting from their implementation. Perhaps more troublesome is the fact that none of them recognizes the need to identify a priori the group of individuals who are good candidates for early retirement so that the plan could be designed to meet their needs. In fact, all have the feature that the higher an individual's salary, the higher will be the bonus paid for his early retirement. Hence, if salary is any indication of an individual's worth to his employer, these

programs are likely to be most appealing to those whom the university would least like to see leave prematurely.

The purpose of this report is to offer a systematic approach to the design of an early retirement program for the Stanford faculty. An attempt is made first to characterize the candidate group, and then to structure a plan involving financial incentives that should be most appealing to that same group. In addition, a mathematical model of faculty flow is used to predict the effects -- in terms of institutional costs and benefits -- of putting the proposed plan into operation. The claim is not made that this is the "ideal plan" for Stanford or for any other institution. However, by making our assumptions explicit and dealing with the issue in some depth, we hope to leave the reader with sufficient understanding of underlying processes that, with little effort, he will be able to examine the implications of his own preferred set of assumptions.

This report is organized into four sections, of which this Introduction is the first. Section II describes the current retirement plan at Stanford in some detail. Included are figures indicating the amount of benefits that are currently being paid those faculty members who have recently retired at the normal age. In addition, a comparison of Stanford's system with those offered by three other institutions is used

to demonstrate how the typical university retirement system encourages its subscribers to remain in active service as long as possible. Section III describes a proposed early retirement program for the Stanford faculty which, when superimposed on the current scheme, attempts to abate some of its more undesirable features. In the last section, we make estimates of the costs and benefits of the proposed plan. For technical details of the mathematical model and historical data used in our analyses, the reader is referred to a companion paper, "Analysis of a Faculty Early Retirement Plan," which is available upon request from the Stanford Academic Planning Office.

II. THE STANFORD TIAA-CREF RETIREMENT PLAN

1. Features of University Retirement Systems

Retirement systems are generally of two types: the fixed contribution rate plan and the per cent of final pay plan. The Stanford arrangement with TIAA-CREF is an example of the former type; the employer and employee each contribute a specified per cent of the employee's salary to his pension account on a routine basis. Contributions are accumulated along with the return on their investment, so that at the time of the individual's retirement his benefit will be computed as the actuarially equivalent income for the size of fund at hand.

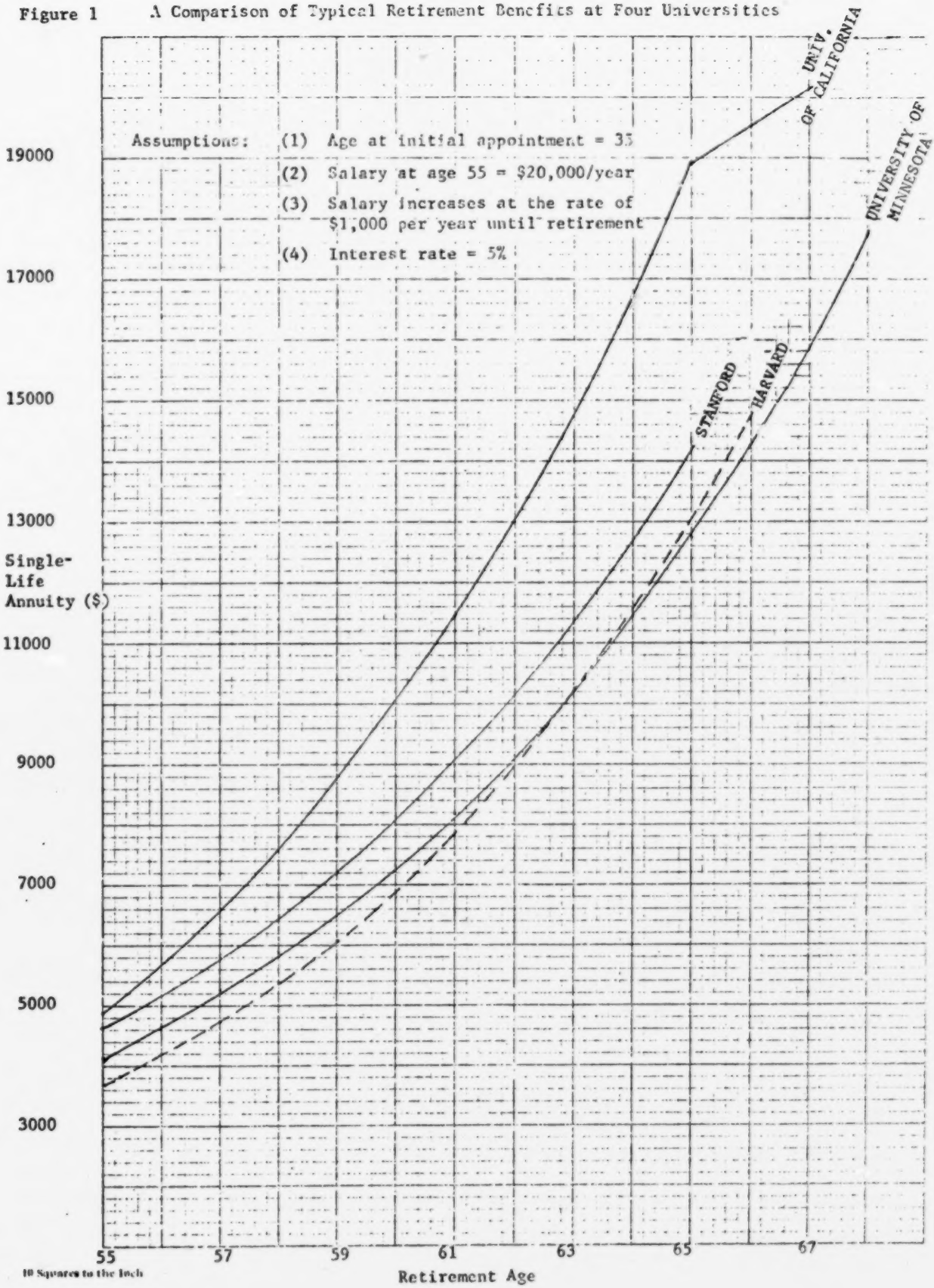
It is instructive to examine the way in which the pension fund and retirement annuity of a typical employee grows under such a plan during the later years of his service life. Consider the case of a man aged 55 whose current annual salary is $20,000. Suppose he has been in active service at Stanford for 20 years and that his salary will increase by $1,000 per year until mandatory retirement at age 65. In this case, the value of the fund currently vested in him will be approximately $60,000. To compute the growth of his fund, one adds the interest earned by the fund to the sum of the annual contribution (at 15% of salary) and the fund already accumulated:

Year	Age (at end of year)	Salary	Contr. to Ret. Fund	Interest	Retirement Fund (at end of year)	Actuarial Conv. Factor	Annual Annuity
1970-71	55				$ 60,000	13.01	$ 4,612
1971-72	56	$20,000	$3,000	$3,075	66,075	12.75	5,182
1972-73	57	21,000	3,150	3,383	72,608	12.48	5,818
1973-74	58	22,000	3,300	3,712	79,620	12.21	6,521
1974-75	59	23,000	3,450	4,068	87,138	11.94	7,298
1975-76	60	24,000	3.600	4,447	95,185	11.65	8,170
1976-77	61	25,000	3.750	4,853	103,788	11.37	9,128
1977-78	62	26,000	3,900	5,286	112,974	11.07	10,205
1978-79	63	27,000	4,050	5,750	122,774	10.78	11,389
1979-80	64	28,000	4,200	6,244	133,218	10.47	12,724
1980-81	65	29,000	4,350	6,770	144,338	10.16	14,206

To convert a retirement fund into an equivalent single-life annuity, one divides the amount of the fund by an "acturial conversion factor." This factor takes account of mortality rates of retired faculty members as well as the interest rate earned on the retirement fund. Thus, it may be interpreted as an expected discounted remaining lifetime. The mortality rates used in the above computations are those applied by TIAA-CREF. The interest rate is assumed to be 5.25% (the current TIAA rate, excluding "extra dividends").

These annuities are plotted against retirement age in Figure 1. For the purposes of comparison, these computations were repeated under the same set of assumptions for three other universities for which we had recent information about their retirement systems. The important characteristics of these four plans are shown in Table 1. Both Harvard and Minnesota employ a variation of the fixed contribution rate plan, while

Figure 1 A Comparison of Typical Retirement Benefits at Four Universities



10 Squares to the Inch

the University of California provides an example of the per cent of final pay plan in which the employee contribution rate is fixed, benefits are specified as a fixed per cent of final salary that depends on age and length of service, and employer contributions are calculated on the basis of the need for reserves to meet current and future commitments out of the entire pooled fund. Retirement benefits at Stanford, Harvard, and Minnesota are fully vested with every employee.

Table 1

Features of Four University Retirement Plans

Institution	Mandatory Retirement Age	Employee Contribution Rate	Employer Contribution Rate
Stanford	65	5%	10%
Harvard	66	-	12.5% up to age 55 15% from age 55 to age 60 20% from age 60 to age 66
University of California	67	4% to 7% (depends on age at entry)	13% to 19% (depends upon length of service)
University of Minnesota	68	2.5%	2.5% on first $5,000 of salary plus 13% on remainder

In the case of the University of California, however, vesting does not begin until an individual has been a member of the system for five years. As one can see in Figure 1, this feature enables the system to pay significantly higher benefits to

long-standing employees who remain to mandatory retirement age than do the other plans, but at the expense of younger members who lose all university contributions as well as a portion of the interest earned on their own at the time of their termination. This system has the obvious disadvantage of encouraging all employees to remain at the University when, in some cases, the University would be better off if they would choose to go elsewhere.

Observe from Figure 1 that in every case an individual's annuity increases at an increasing rate with his age. For a fixed contribution rate plan, this feature is the compound result of three factors: (a) an additional year's interest being earned on the fund already accumulated, (b) an additional contribution being made to the fund that is proportional to the individual's salary (also growing), and (c) a decrease in the individual's expected remaining lifetime. In the case of Stanford, a man's retirement income nearly doubles between the ages of 59 and 65. The reason that the final pay plan at the University of California has the same feature is that it was designed that way. It is clear that all of these plans encourage their subscribers to remain in active service as long as possible.

2. Actual Benefits of the Stanford Plan

What amount of benefits are actually provided by the Stanford plan for normal (age 65) retirement? Table 2 shows the range of pension paid during 1971 by TIAA and CREF to male faculty members who have retired in each of the past five years after at least 15 years of service at Stanford. Women have been

excluded so as not to bias the results; we note in passing, however, that the pensions paid to female faculty members are typically lower than those for males with the same length of service because they have a longer expected remaining lifetime at retirement age. Annuities paid under other options have been converted to a single-life annuity basis. There is a tremendous variation in the amount of benefits provided for different individuals because these are sensitive to such factors as salary history and length of service. Apparently, the plan can provide an individual who has served for 30 or more years with a retirement income of some 40 to 50 per cent of his final salary. Of course, for those who choose to contribute significantly more than the required 5 per cent of their salaries while they are in active service, the benefit may be considerably greater.

Table 2

Benefits Paid to Retired
Stanford Faculty Members During 1971

Retirement Year	Size of Group	Min. Pension	Median Pension	Max. Pension
1967	2	$7,381	$ -	$11,975
1968	7	2,669	6,255	17,281
1969	9	3,574	6,341	12,503
1970	2	7,859	-	8,491
1971	7	6,413	10,377	14,[illegible]8

Source: TIAA-CREF, private communication

Notes: (a) All pensions converted to single-life annuity basis.
(b) Females excluded.

It is instructive to compare the Stanford benefits with those offered by private industry and the Civil Service. In a

study of the pension plans of several hundred large corporations, Foote and McLaughlin [1965]* reported that for executives and middle managers about 70 per cent of the plans yielded benefits in the range of 30 to 50 per cent of the average salary of an employee's final five years. The Civil Service Retirement System has features similar to those of the University of California plan. An active employee regularly contributes 6.5 per cent of his gross pay to the fund; upon retirement after 32 years, say, he is guaranteed a single-life annuity of 60 per cent of his final average salary. Vesting does not begin until a person has completed at least five years of service. Thus, when the advantages of full vesting are taken into account, it would appear that the benefits provided by Stanford to faculty members retiring at age 65 compare reasonably well with those provided by government, industry, and other universities. Whether these benefits are truly adequate is really an unanswered question; about all that can be said is that they seem to conform to the norm for professional employees in the United States.

3. Effects of Social Security

The Social Security System provides all employees with a certain level of tax-free retirement income. Payments are made into the system in equal shares by employers and employees at a rate that, for professionals, is independent of age and salary level. The current maximum level of income provided a man who retires at age 65 and who has a dependent wife is $3,840 per year. Clearly, although the impact of Social Security is not negligible, most professionals draw by far the major

* Foote, G. H., and D. J. McLaughlin, "The President's Stake in Pension Planning," Harvard Business Review, September-October 1965, 92-93.

portion of their retirement income from the plans established by their employers. At any rate, while its effects should be taken into account, Social Security can be viewed only as an extrinsic factor in the formulation of institutional early retirement policies.

The individual who retires early is penalized financially in three ways. In the first place, he must substitute pension income for salary income in the interval from retirement to age 65. Secondly, if he survives to 65, the income he will receive from his pension will be considerably less than it would have been had he remained in active service until mandatory retirement age. Finally, Social Security provides no benefit until age 62 at which point there is a 20% reduction from the age 65 lifetime income level. Therefore, to provide incentive for early retirement it is obvious that the University must offer some form of supplementary retirement income prior to age 65. There is an infinite variety of plans that might be formulated for this purpose. One such plan is described in the next section.

III. AN EARLY RETIREMENT PROGRAM

1. Retirement Income as a Function of Age, Salary, and Length of Service

As a preliminary to describing the proposed incentive scheme, in this section we derive an approximation to the final value of an individual's pension fund under the Stanford TIAA-CREF plan. This result will be used extensively in the formulation and analysis of the early retirement program.

Let S_t be the individual's salary at age t, t_o be the age at which he first enters employment, and t_f be his age at retirement. If the (employer plus employee) contribution rate is r and contributions earn interest at the compound rate i, the value of the contribution made in year t at the time of retirement must be $(1 + i)^{t_f - t} r S_t$. The final value of the fund, denoted V_f, is obtained as the sum of contributions plus interest for periods t_o, $t_o + 1$, ..., and t_f:

$$(1) \qquad V = (1 + i)^{t_f - t_o} r S_o + (1 + i)^{t_f - t_o - 1} r S_1 + \ldots + r S_f .$$

Suppose one assumes that salary grows at a constant geometric rate, g, i.e., $S_t = (1 + g)^{t - t_o} S_o$ for $t = t_o, t_o + 1, \ldots, t_f$. Then expressing V_f in terms of final salary, S_f, one obtains

$$(2) \qquad V_f = \left[\left(\frac{1+i}{1+g}\right)^{t_f - t_o} + \left(\frac{1+i}{1+g}\right)^{t_f - t_o - 1} + \ldots + \left(\frac{1+i}{1+g}\right) + 1\right] r S_f .$$

Now assume the interest rate, i, and the salary growth rate, g, are equal. Then (2) simplifies to

$$(3) \qquad V_f = r T S_f ,$$

where $T = (t_f - t_o + 1)$ is the length of service.

We recognize that these assumptions regarding salary history are not valid in all cases. However, except in those cases in which the average growth rate of salary is more than the average rate of investment return, Eqn. (3) will underestimate rather than overestimate the final value of an individual's accumulated fund. As the reader will see, this means that our estimates of the cost of the new plan will probably be overstated rather than understated.

Recall from Section II.1 that the retirement annuity, denoted a, is obtained as the quotient of the fund in Eqn. (3) and an actuarial factor, m_f :

$$(4) \qquad a(T, t_f) = r T S_f / m_f .$$

Eqn. (4) states that, as an approximation, an individual's annuity is the product of three variables -- the contribution rate, his length of service, and his final salary -- divided by his expected discounted remaining lifetime. The factors m_f for males corresponding to the current TIAA interest rate (excluding "extra

dividends") of 5.25% are plotted against retirement age, t_f, in Figure 2. The effects of age and service life on retirement income in such a plan are now apparent: (1) the annuity increases linearly with service life for a given retirement age and (2) since salary increases geometrically and the actuarial factor decreases (more or less) linearly with age, for a fixed value of service life the annuity increases at an increasing geometric rate with retirement age.

These observations were made with different individuals in mind. What is relevant for a given individual of age t and length of service T is a comparison of $a(T, t)$ with $a(T + 1, t + 1)$:

$$(5) \qquad \frac{a(T + 1, t + 1)}{a(T, t)} = \frac{V_{t+1}}{V_t} \cdot \frac{m_t}{m_{t+1}} \quad \text{by (3) and (4)} .$$

Now, from (2) we have

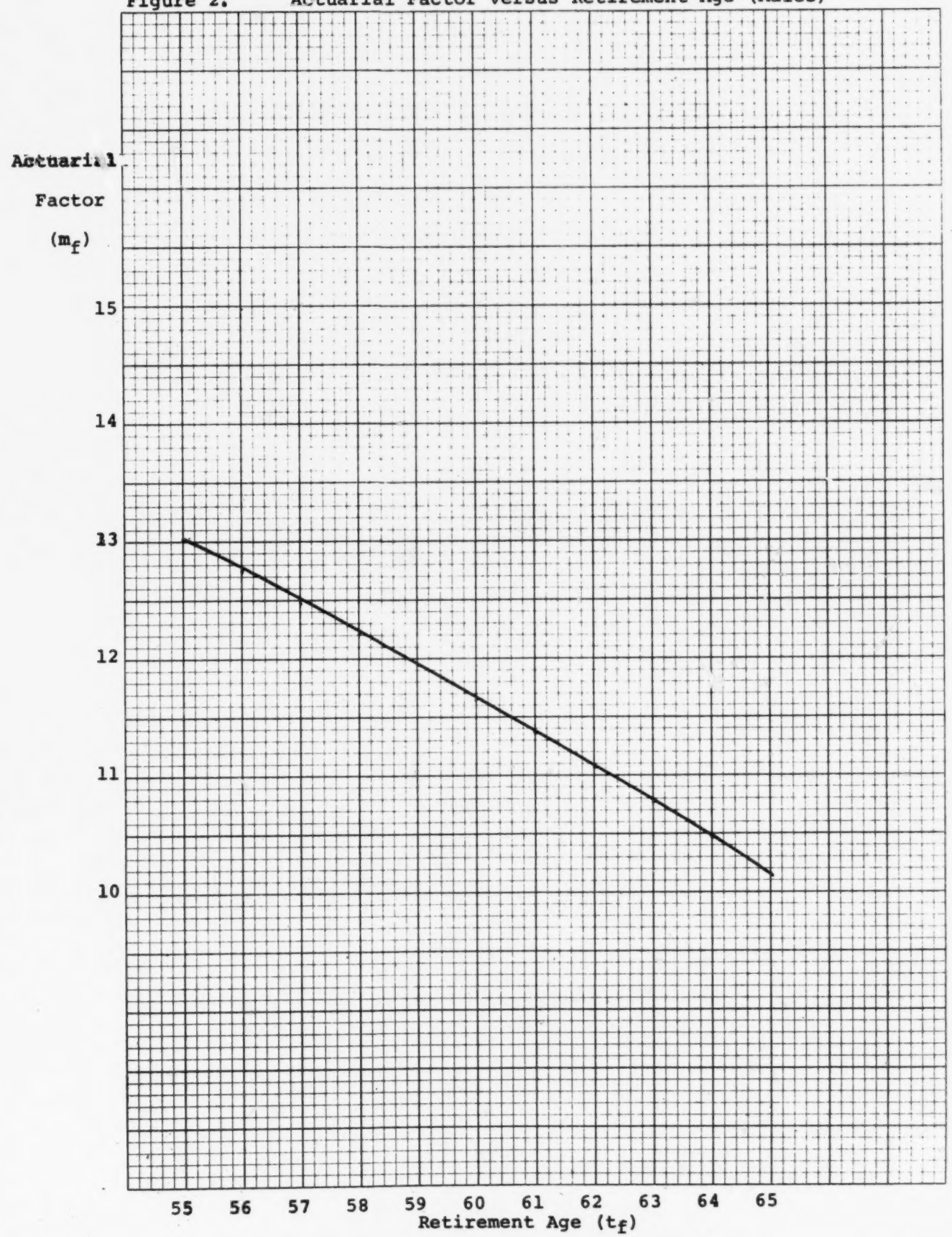
$$V_{t+1} = (1 + i)\, V_t + r\, S_t ,$$

which when combined with (3) yields

$$(6) \qquad \frac{a(T + 1, t + 1)}{a(T, t)} = \left[1 + i + \frac{1}{T}\right] \frac{m_t}{m_{t+1}} .$$

Equation (6) shows precisely how an individual's annuity grows in amount as the result of his decision to wait another year before retiring. In words, the rate of increase in benefits is the product of two terms, the first of which is the sum of the interest rate and the reciprocal of the lifetime, and the

Figure 2. Actuarial Factor versus Retirement Age (Males)



second of which is the reciprocal ratio of consecutive annuity factors. The actual magnitude of this rate is generally in the range of 10 to 20 per cent. Such are the effects that must be taken into account in the design of any early retirement program.

2. Identification of Early Retirement Candidates

Earlier in the current academic year, the deans of Schools were asked to identify members of their faculties with whom they would be willing to try to work out a settlement involving the payment of some supplemental retirement income in return for a voluntary early retirement. In practically every case, the candidates selected by the deans had one important characteristic in common, namely a salary level that was significantly below the median for their age group within the School. Moreover, in attempts to have the deans further refine their lists, it became apparent that the relationship was nearly one-to-one; not only did selected candidates fall in the lower salary group, but also any individual in that group was likely to appear on the candidate list. A lesser influence was exerted by length of service, so that an individual with a low salary and long service life was even more likely to be on the list. Surprisingly,

however, quite a few names appeared whose associated service lives were only in the range of from 10 to 15 years.

A study of 1971-72 salaries for tenured faculty in the School of Humanities and Sciences revealed several interesting features. In the first place, the results shown in Table 3 suggest the hypothesis that age has little influence on salary level once one has reached 45. Since length of service is recognized to be an influential factor, this was further tested by examining the mean and median salaries for these age groups when the length of service is held to a fixed range. The results for length of service between 10 and 19 years are shown in Table 4. They would appear to lend further evidence to the validity of the hypothesis.

Table 3

School of Humanities and Sciences:
Mean Salary by Age Group

Age	Number in Group	Mean Salary
30-34	20	$15,498
35-39	46	18,428
40-44	49	19,784
45-49	49	21,689
50-54	45	22,423
55-59	32	22,058
60-64	35	21,906

Notes: (a) Source: Academic Planning Office Faculty Data File
(b) Salaries are for the 1971-72 academic year.
(c) Includes only tenured faculty not holding administrative appointments.

Table 4

School of Humanities and Sciences:
Mean and Median Salaries by Age Group for Tenured
Faculty With Service Lives Between 10 and 19 Years.

Age	Number in Group	Mean Salary	Median Salary
45-49	30	$21,300	$20,800
50-54	20	22,100	23,000
55-59	15	22,900	25,200
60-64	8	23,200	22,600

A more significant relationship was found to exist between salary and length of service for a given age group. For example, the mean and median salaries for tenured Humanities and Sciences faculty between the ages of 50 and 54 are shown in Table 5 grouped according to service life. As one might expect, the relationship is an inverse one, with those who have been recruited recently from another institution being at a higher level of salary than those who have remained at Stanford for a long time.

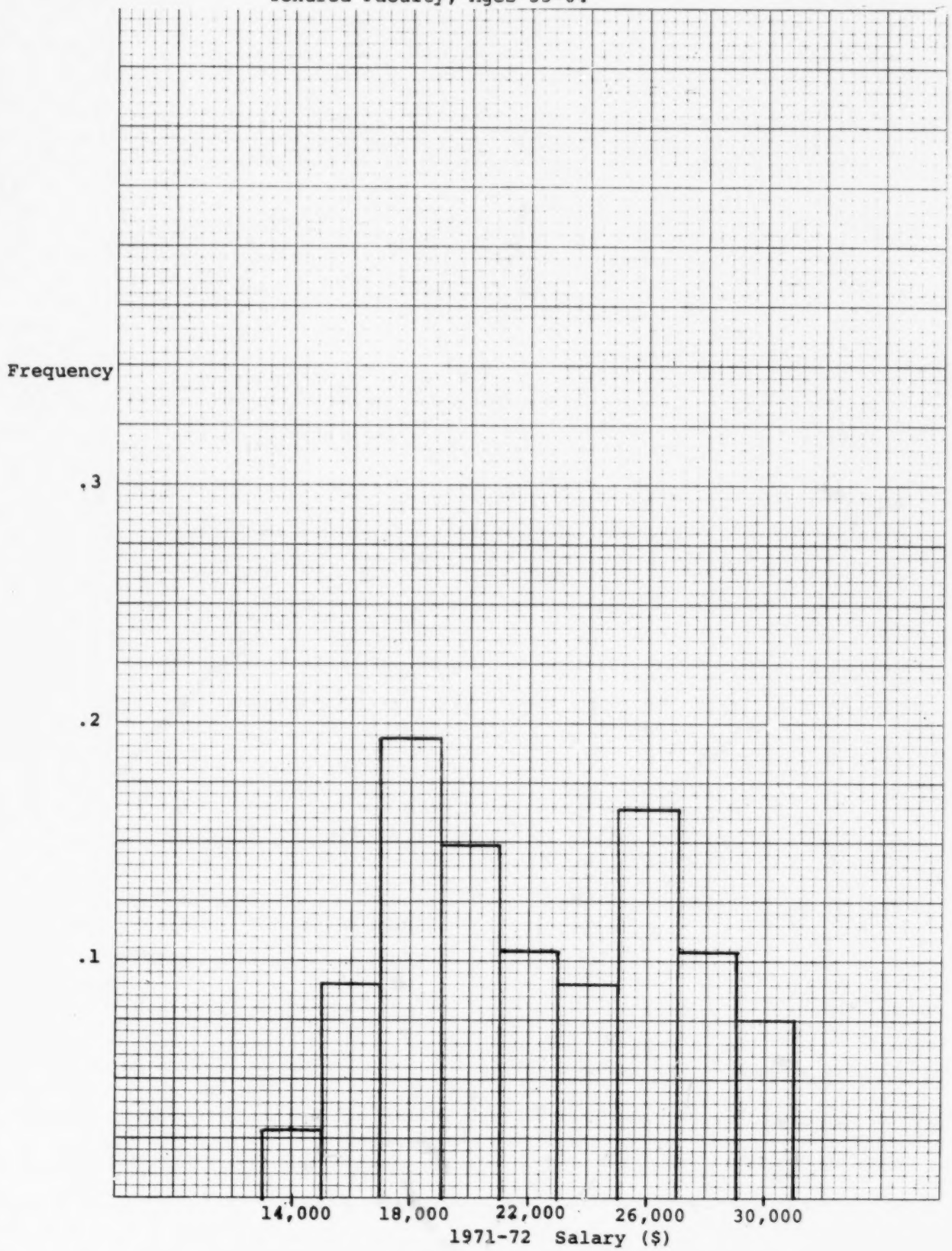
Table 5

School of Humanities and Sciences:
Mean and Median Salaries by Service Life For Tenured
Faculty With Ages Between 50 and 54

Length of Service (in years)	Number in Group	Mean Salary	Median Salary
0-9	18	$23,600	$24,800
10-19	20	22,100	23,000
20-29	8	19,600	20,000

In Figure 3 the actual 1971-72 salary distribution is plotted for tenured faculty members in the School of Humanities and Sciences who are between the ages of 55 and 64 (the group for which we wish to formulate an early retirement policy). Observe that the distribution

Figure 3. Salary Distribution, School of Humanities and Sciences, Tenured Faculty, Ages 55-64



is bimodal. This phenomenon is explained only in part by differences in length of service; for there are a number of long-standing faculty members in the higher salaried group and a number of recent recruits in the lower salaried group. Our conversations with the deans would seem to indicate, rather, that within this older age group salary differences are explained primarily by differences in individual merit and productivity.

In designing incentives for early retirement, we shall proceed on the assumption that the group we wish to encourage most to retire are those at the lower end of the salary spectrum. As a secondary effect, we shall also wish to offer greater incentive to an individual with a long service life than to one with a short service life. A structure that meets these objectives well is one in which minimum retirement benefits are specified as a function of age and length of service. Since accumulations are roughly proportional to final salary (see Eqn. [3]), a plan which provides for minimum benefits offers a higher amount to those whose low salaries have kept them from accumulating as large a fund as their more highly paid colleagues. In addition, one can control for length of service both by restricting eligibility for the plan to those with a specified minimum service life and by making the early retirement supplement for those who are eligible increase with service time.

3. Proposed Incentive Scheme

It would be prudent to restrict the eligibility for early retirement benefits to faculty members (1) who have reached the age of 55, (2) who have served at least 10 years at Stanford, and (3) who have obtained the consent of the appropriate administrative officer. There are several reasons for which the University might want to retain the right to deny participation to individual faculty members. These have to do with the need to maintain a proper balance of faculty between various academic programs on the campus and the fact that often a suitable replacement cannot be found in a short period of time. To protect the University against changing conditions of supply and demand in the academic labor market, it is further recommended that the plan be implemented on a temporary basis with the University retaining the right to review and revise it after three or four years.

The following are definitions of the terms that will be used in describing the plan:

Years of service is the number of years during which a faculty member has been a subscriber to the Stanford TIAA-CREF plan. (Because subscription to the plan is not mandatory, a small percentage of employees choose not to belong during their younger years. Nearly all

of those who are 55 and older do belong to the plan, however.)

Guaranteed minimum income refers to the single-life annuity equivalent of the benefit provided by the sum of the University early retirement supplement and the individual's TIAA-CREF fund at the time of his retirement. Because it is based on the fund value at a single point in time, it establishes a fixed level of supplement to be paid by the University on a periodic basis. Therefore, once it is calculated for a given individual, this supplement will not be affected by future changes in the TIAA dividend rate or fluctuations in the value of CREF units.

Median professor refers to a hypothetical faculty member who each year is paid the median professor's salary in his School as reported in the Controller's annual statistics.

Our goal in structuring a schedule of minimum benefits for early retirement was to provide each individual between the ages of 55 and 64 with that level of fund which he would have accumulated at age 65 if he were paid the median salary of his School during each year of service. This was accomplished in three steps:

(1) For each value of age and length of service, an estimate was made via Eqn. (3) of the fund that would be accumulated at mandatory retirement age by a median professor with those same age and service attributes.

(2) This quantity was divided by the actuarial factor corresponding to the given age to obtain the minimum annual retirement income.

(3) To account for inter-School variations the minimum income was expressed as a per cent of the median salary for professors in a School. (See Table 6.)

The exact nature of these computations is described below. Notice that in Step (2) the early retirement benefit is calculated to provide full funding (that is, the expected accumulation at age 65) for the median professor; he is asked to bear only the actuarial reduction that results from his retirement at a younger age. Of course, the bonus is greater still for those with salaries below the median.

Let $\hat{S}$ be the current median professor's salary for the School. We assume this quantity will increase at the compound annual rate of 4%. According to Equation (3), the accumulated fund at age 65 of the median professor who is today of age t and with length of service T will be

approximately

$$V_{65} = r\ (T + 65 - t)\ (1.04)^{65-t}\ \hat{S}\ .$$

To obtain the minimum benefit, b, we divide this quantity by the actuarial factor m_t ; the result, expressed as a per cent of the median salary, is as follows:

$$b(T, t) = \frac{100r\ (T + 65 - t)\ (1.04)^{65-t}}{m_t}\ .$$

In contrast to the result of Section III.1, it is easily seen that in this scheme the ratio of consecutive annuities for an individual who remains in service is simply m_t/m_{t+1}, and therefore is independent of salary and length of service. That is provided, of course, that the individual's own accumulated fund is insufficient to provide a higher benefit than the guaranteed minimum. One interesting characteristic of this system is that the fund of a high-salaried individual who remains in service beyond age 55 eventually overtakes the minimum value, so that for this group the original incentives against early retirement remain in effect.

The minimum guaranteed retirement benefit, b(T, t), is shown as a function of age and length of service in Table 6. In constructing this table we have used a value of .16 for the

contribution rate, r, under the assumption that most faculty members will continue to contribute their portion under the tax-deferred plan. (At present, many persons are regularly contributing more than eight per cent of their own salaries under this plan.)

It is instructive to examine the effects such a plan would have on the options of certain faculty members. Consider the School of Humanities and Sciences in which the median professor's salary in 1971-72 is $21,500. Figures 4, 5, and 6 show salary and earned and minimum retirement benefits as a function of age for a low-, median-, and high-salaried professor, respectively. The assumptions used in determining these quantities were as follows: (1) the individual is currently 55 years old with service life 20 years and is earning a salary of $16,500 (low), $21,500 (median), or $26,500 (high); (2) all salaries increase at the annual rate of 5 per cent; (3) the total contribution rate is 16 per cent; and (4) the annual rate of return earned on the retirement fund is 5 per cent. Also shown in these graphs are estimates of the discounted salary savings that would accrue to the University as the result of the early retirement of the given individual if he were replaced by a junior faculty member. Additional assumptions used in these computations were: (5) the replacement is hired at a salary of $12,100; (6) for each faculty member, the University

TABLE 6

MINIMUM GUARANTEED RETIREMENT BENEFITS
(EXPRESSED AS A PER CENT OF MEDIAN SALARY)

YEARS OF SERV.	RETIREMENT AGE 55	56	57	58	59
10	36.4086	33.93608	31.58224	29.31468	27.12904
11	38.22903	35.72218	33.33681	31.03909	28.8246
12	40.04947	37.5083	35.0914	32.76349	30.52017
13	41.8699	39.2944	36.84596	34.48787	32.21574
14	43.69034	41.08051	38.60052	36.21227	33.91132
15	45.51076	42.86662	40.35509	37.93668	35.60686
16	47.33119	44.65274	42.10968	39.66106	37.30243
17	49.15163	46.43886	43.86424	41.38545	38.998
18	50.97206	48.22495	45.6188	43.10985	40.69357
19	52.79248	50.01106	47.37337	44.83423	42.38913
20	54.61292	51.79718	49.12796	46.55864	44.0847
21	56.43335	53.58328	50.88252	48.28304	45.78027
22	58.25378	55.3694	52.63708	50.00742	47.47583
23	60.0742	57.15552	54.39165	51.73181	49.17139
24	61.89464	58.9416	56.14624	53.45622	50.86696
25	63.71507	60.72772	57.9008	55.18062	52.56253
26	65.53551	62.51384	59.65536	56.905	54.2581
27	67.35594	64.29996	61.40993	58.62939	55.95366
28	69.17638	66.08606	63.16452	60.35381	57.64922
29	70.9968	67.87216	64.91908	62.07819	59.34479
30	72.81723	69.65828	66.67365	63.80258	61.04036
31	74.63765	71.44438	68.42821	65.52698	62.73592
32	76.45808	73.2305	70.1828	67.25136	64.43149
33	78.27852	75.01662	71.93736	68.97577	66.12706
34	80.09895	76.8027	73.69193	70.70016	67.82263
35	81.91939	78.58882	75.44649	72.42455	69.51817
36	83.73982	80.37494	77.20108	74.14894	71.21375
37	85.56026	82.16104	78.95564	75.87335	72.90932
38	87.38069	83.94716	80.71021	77.59773	74.60489
39	89.2011	85.73328	82.46477	79.32213	76.30045
40	91.02153	87.51936	84.21936	81.04652	77.99602

TABLE 6 (CONTINUED)

YEARS OF SERV.	RETIREMENT AGE 60	61	62	63	64
10	25.06404	23.0473	21.13562	19.2641	17.48233
11	26.73499	24.69354	22.76144	20.86945	19.07162
12	28.40591	26.33978	24.38725	22.47478	20.66093
13	30.07684	27.98601	26.01308	24.08012	22.25023
14	31.74779	29.63225	27.6389	25.68547	23.83954
15	33.41872	31.27849	29.26471	27.29079	25.42883
16	35.08966	32.92473	30.89053	28.89615	27.01813
17	36.76059	34.57095	32.51634	30.5015	28.60742
18	38.43155	36.21719	34.14217	32.10681	30.19673
19	40.10246	37.86343	35.76799	33.71217	31.78603
20	41.77339	39.50967	37.3938	35.31752	33.37535
21	43.44435	41.1559	39.01962	36.92284	34.96465
22	45.11528	42.80214	40.64543	38.5282	36.55396
23	46.78622	44.44838	42.27126	40.13354	38.14325
24	48.45715	46.09462	43.89708	41.73886	39.73254
25	50.1281	47.74084	45.52289	43.34422	41.32185
26	51.79903	49.38708	47.14871	44.94957	42.91115
27	53.46997	51.03333	48.77452	46.55489	44.50046
28	55.1409	52.67957	50.40034	48.16025	46.08975
29	56.81183	54.32579	52.02617	49.76559	47.67908
30	58.48279	55.97203	53.65198	51.37094	49.26837
31	60.1537	57.61827	55.2778	52.97627	50.85768
32	61.82466	59.26451	56.90361	54.58162	52.44698
33	63.49559	60.91074	58.52943	56.18697	54.03627
34	65.16653	62.55698	60.15526	57.7923	55.62558
35	66.83746	64.20322	61.78107	59.39764	57.21487
36	68.50839	65.84947	63.40689	61.00299	58.8042
37	70.17934	67.49568	65.0327	62.60832	60.39348
38	71.85027	69.14192	66.65852	64.21367	61.9828
39	73.52121	70.78818	68.28435	65.81902	63.5721
40	75.19214	72.43442	69.91016	67.42435	65.16139

Figure 4. Early Retirement Benefits for a Low-Salaried Professor

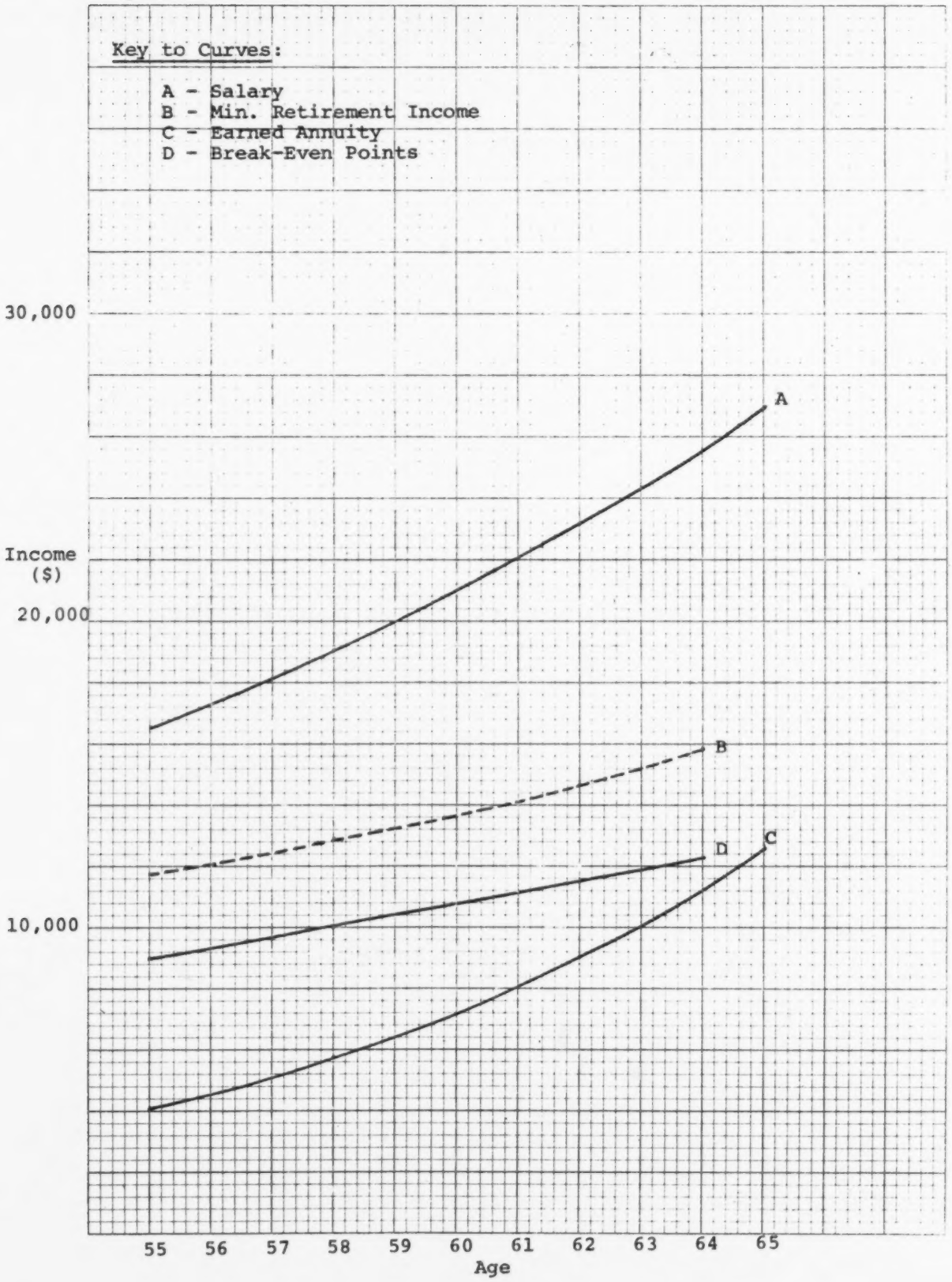


Figure 5. Early Retirement Benefits for a Median-Salaried Professor

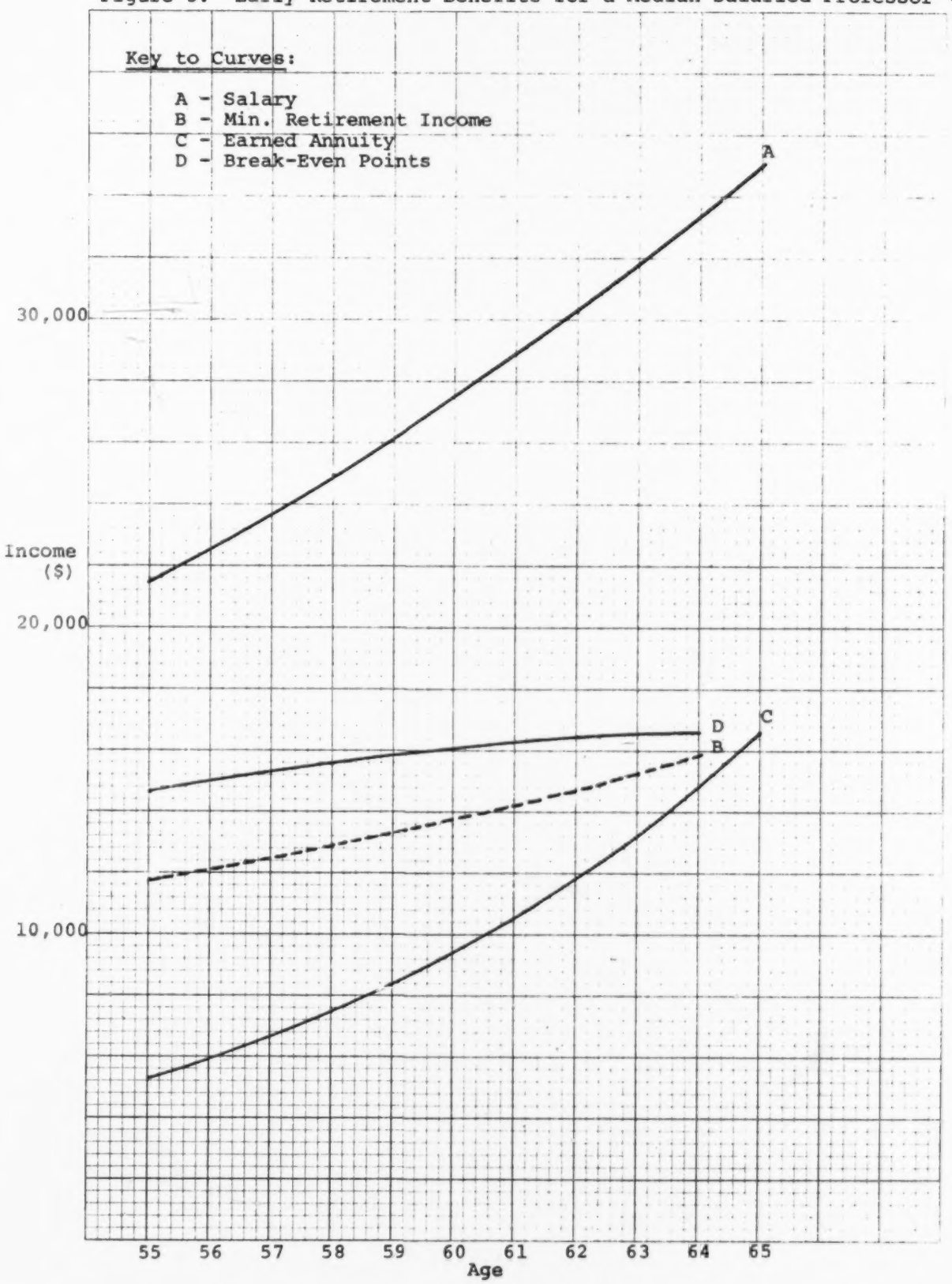
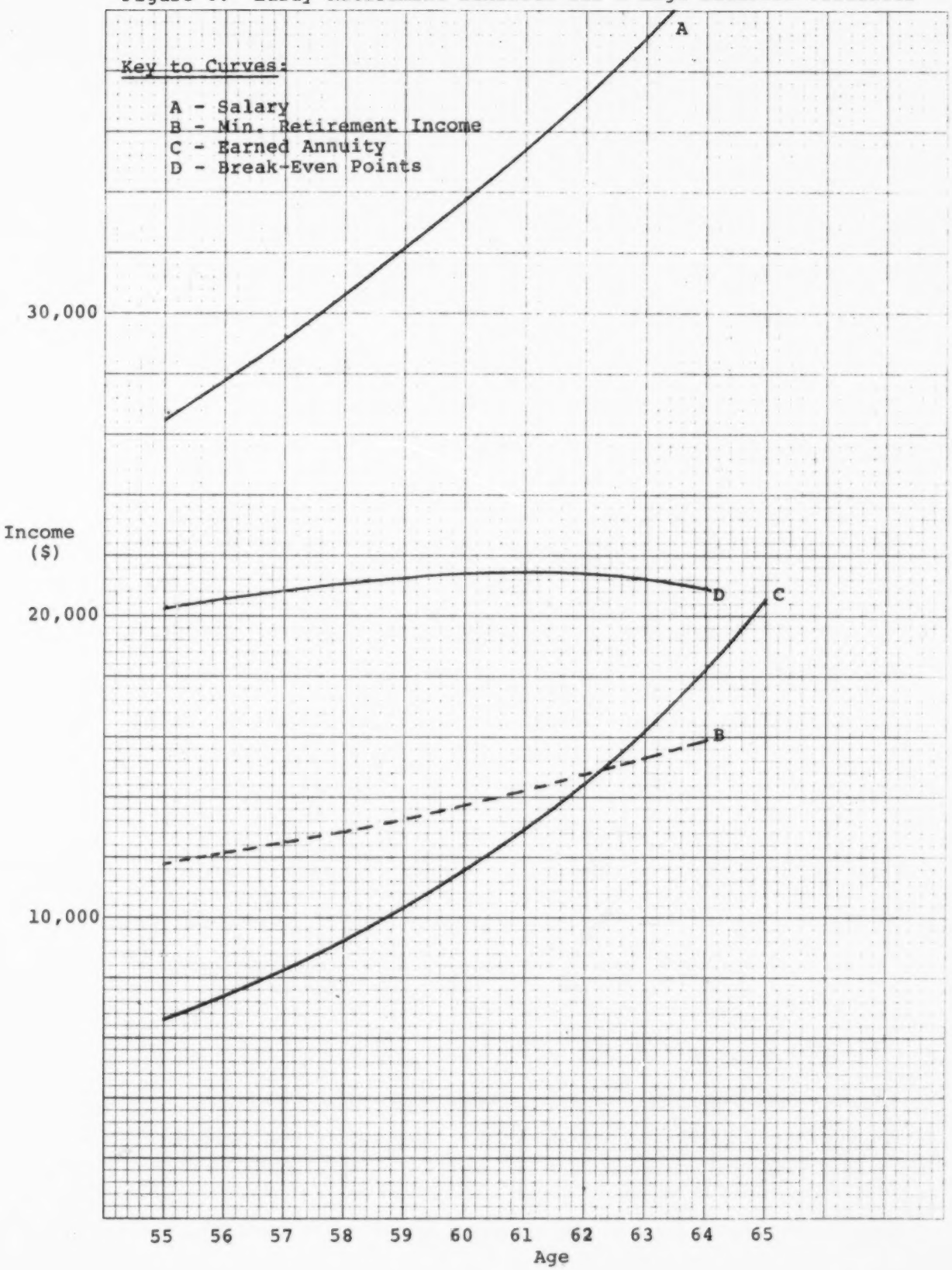


Figure 6. Early Retirement Benefits for a High-Salaried Professor



contributes 10 per cent of salary to the TIAA-CREF plan; and (7) the discount rate is 5 per cent. In Figures 4, 5, and 6, "A" denotes the salary curve, "B" signifies the minimum retirement benefit curve and "C" denotes the curve of annuities earned from the regular TIAA-CREF plan. Curve B was constructed by multiplying the median salary -- $21,500 at age 55, 1.05 x $21,500 at age 56, $(1.05)^2$ x $21,500 at age 57, etc. -- by the appropriate underlined factor from Table 6. The distance between curves C and B shows the supplement that would be offered by the University under the proposed plan. Finally the distance between curves C and D represents the annuity equivalent of the discounted savings. Thus, a "break-even" policy in which the savings resulting from the individual's replacement are passed on directly to him would result in his being paid the total benefit on curve D.

In no case is the minimum retirement benefit greater than the individual's salary. However, for the individual in Figure 4, the benefit approximates 70% of salary at age 55 which might make early retirement a rather appealing option. If he chooses to exercise this option, the University will incur a positive net cost since, for this individual, the minimum benefit curve lies substantially above the earned annuity plus salary savings curve. However, the reverse is true in Figure 6; for the case represented there, early retirement will yield a positive savings for the University.

Now, although the plan was designed primarily to encourage members of the low-salary group to participate, certainly there are members of even the high-salaried group who are not indispensable to the University. Since participation is to be by mutual agreement of the individual and the University, this provides the University with an opportunity to partially offset the costs incurred by a larger number of retirements from the low-salary group with a few selected retirements from the high-salary group.

Another aspect of the proposed plan worth noting is the discontinuity that will exist between age 64 and age 65 benefits, for no benefit is specified for mandatory retirement at 65. Although we have not made the adjustment in our computations in Section IV, this discontinuity can be eliminated by modifying the plan so that the amount of the University-paid supplement will decrease in stages during each individual's final years of service. To be more precise, one need only change the rules for computing the early retirement benefit for ages 63 and 64 as follows: calculate the supplement that would have been paid had the individual chosen to retire at age 62; whatever the amount of that supplement, offer two-thirds as much at age 63 and one-third as much at age 64. For example, consider the low-salaried professor of Figure 4. At age 62, his earned annuity is worth $9,100 while the minimum retirement benefit is $14,800; thus, the supplement

would be $5,700. Under the revised rules, the University would offer this individual a supplement of $3,800 at age 63 and $1,900 at age 64, or a total retirement income of $13,900 and $13,200 per year, respectively (as compared with $15,300 and $15,900 under the unrevised plan).

It should also be noted that rather conservative assumptions were used in the construction of Table 6. First of all, many faculty members have been contributing more than 6 per cent of their salaries to their own funds; the actual accumulations will be greater in these cases. Furthermore, we have assumed a 5 per cent return on retirement funds whereas, in fact, the current TIAA rate is 7 per cent. As a result, we would expect the effects of the new plan to be somewhat less pronounced than they would appear from these illustrations.

While the benefits of the early retirement plan have been expressed in terms of single-life annuities in Table 6 and Figures 4, 5, and 6, it is important that the individual be given as much flexibility as possible in determining the actual scheme under which the funds allocated to his early retirement will be paid out. Not only should he be given the standard options of fixed versus variable and single-life versus joint-life annuity, but other possibilities

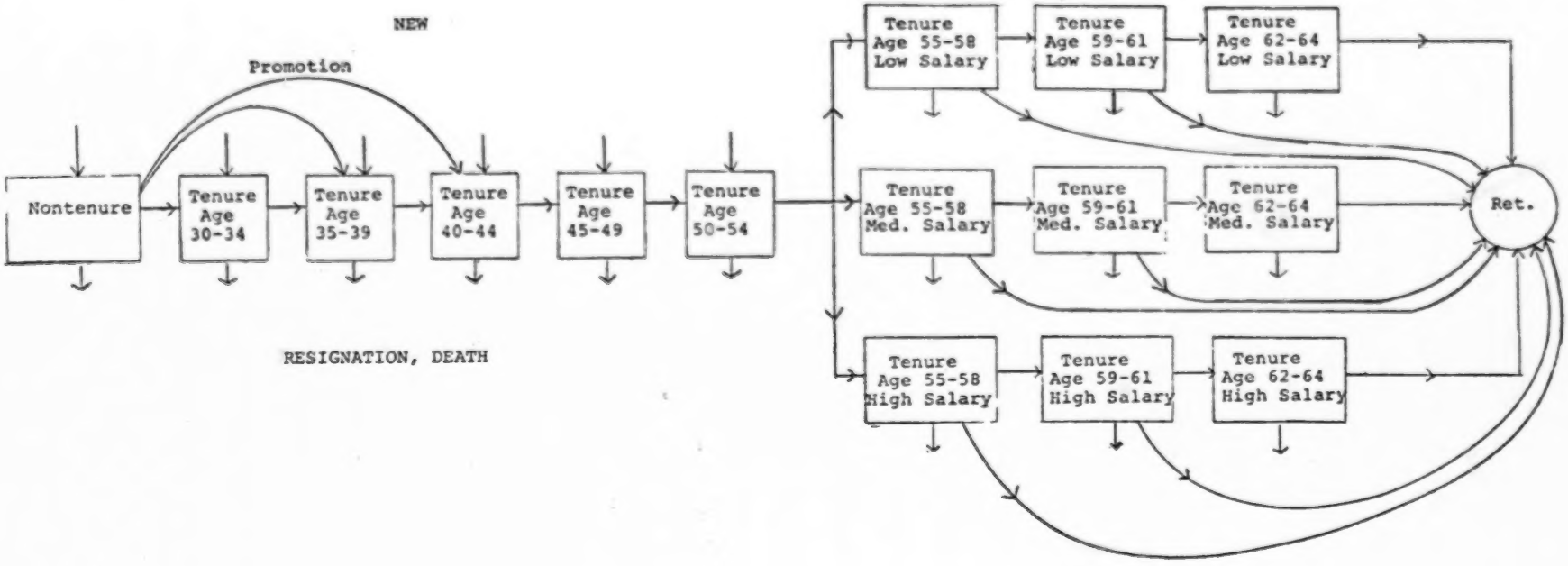
as well. For instance, some persons might prefer to have the entire supplement paid out during the years prior to age 65 when they will become eligible for full Social Security payments. (A supplementary income of $5,000 per year for life beginning at age 60 is equivalent to approximately $13,000 per year during the interval from 60 to 65.) Conceivably, certain individuals might be given the option of taking the entire sum to invest or otherwise use as they please. The entries in Table 6 specify minimum benefits in terms of a single common denominator; these may be converted to equivalent benefits under different options through the use of standard actuarial formulas.

Finally, since at present there is no early retirement program at Stanford, it is not surprising that the Emeritus title and the privileges pertaining thereto are normally reserved for those who retire at the mandatory age of 65. Along with the proposed financial incentive scheme it is recommended that a change in policy be effected to provide these perquisites upon request to any faculty member who chooses to retire early. Furthermore, as these privileges are rather limited in nature, some thought should be given to adding new ones that could in themselves provide more inducement for early retirement.

IV. COSTS AND BENEFITS OF THE PROPOSED PROGRAM

A mathematical model of faculty flows was used to predict both short-run and equilibrium effects on faculty stocks, appointments, and salary costs under the proposed plan. In the model, a faculty member is viewed at a given point in time as belonging to one of several "states"; transitions between states and to the outside world (through death and resignation) were assumed to follow the pattern actually observed in the School of Humanities and Sciences during the period September 1, 1966, to September 1, 1971. The states were defined in a way that takes account of whether an individual holds a tenured or nontenured position, and for the tenured group age is included in the definition as well. Nine states were allotted to those eligible for early retirement; these correspond to three age groupings, (55 to 58, 59 to 61, and 62 to 64) and, within each age grouping, three levels of salary (low, medium, and high). See Figure 7 for a schematic representation of the flow process. The older age groups were differentiated according to salary for two reasons: (1) the amount of benefits paid to those who opt for the plan depends on the salary level, and (2) presumably an individual's propensity to retire under the plan is inversely related to his salary level. In the formulation it was assumed there would be no transfers between salary levels after age 55; once an individual was on a "low-salary track", for example, he would remain there. Certain

Figure 7. A MODEL OF THE FACULTY FLOW PROCESS



transitions are viewed as being policy-dependent; in particular, it is straightforward to use the model to test different assumptions about the promotion rate for nontenure faculty, the rank and age distribution of new appointments, and the propensities to retire.

1. Equilibrium Results

All results were obtained on a School-by-School basis for those three Schools having more than 100 faculty members, while the smaller Schools were grouped together along with faculty in the Food Research Institute, Physical Sciences Program, SLAC, and Physical Education Program in a fourth category. The equilibrium computations assume the faculty size is fixed and the same appointment, promotion, and retirement policies are followed for a long period of time. Under these conditions, the numbers of faculty members in the various states will approach an equilibrium distribution that will be repeated from one period to the next. Along with the equilibrium distribution will be associated fixed levels of flows, such as the number of appointments, resignations, and retirements occuring in each time period.

A comparison was made between the status quo in which no early retirement policy exists and the situation that would be likely to prevail after the implementation of the proposed plan. Certain assumptions were common to both sets of computations. These were: (1) the total faculty size will remain fixed in each School at its present level; (2) new appointments to tenure will be

distributed among age groups the same as the actual appointments made to the School during the past three years; (3) of those initially appointed to nontenure, 30 per cent will eventually be promoted to tenure; (4) the age distribution of these promotions will be the same as that of those who are currently serving in their fourth, fifth, and sixth year of a nontenure appointment in the School; (5) the average lifetime in nontenure is 4.5 years; and (6) the combined annual resignation and mortality rate for faculty between the ages of 55 and 64 will be 2.5 per cent (approximately the observed value in Humanities and Sciences during the past five years). The status quo computations assume further that 80 per cent of all new appointments will be to nontenure positions.

For the early retirement calculations, some precise assumptions had to be made about the propensities of faculty in the different salary groups to retire at different ages. Since no empirical values exist for these parameters, it was necessary to specify subjective estimates. The numerical values shown in Table 7 below refer to the fraction of a cohort entering a state that will retire from that state; for example, of 100 people from the low-salaried group who reach age 55, it was assumed that 30 would retire between the ages of 55 and 58, 50 per cent of those remaining (after retirements, resignations and deaths) would retire between 59 and 61, and 80 per cent of those remaining after 61 would retire between 62 and 64.

Table 7

Estimated Propensities
To Retire

Salary Group	Retirement Age 55-58	59-61	62-64
Low	.3	.5	.8
Medium	.2	.4	.7
High	.05	.1	.2

With the early retirement policy in effect, all additional vacancies resulting from early retirements were assumed to be filled by nontenure appointees. That is, the absolute numbers of new appointments to tenure were set equal to their status quo values and the new appointment rate to nontenure was equated to the difference between the total vacancy rate and the total tenure appointment rate.

Stocks and flows before and after implementation of the early retirement policy appear in Table 8. The entries in the first three columns under each policy represent the equilibrium numbers of faculty members in different categories, while "New Appointments" and "Early Retirements" refer to flows, i.e., numbers of persons joining or leaving the system per year. These results were combined with information about 1971-72 faculty salaries in each School to obtain the estimates of equilibrium costs shown in Table 9. No attempt was made to

Table 8. Steady-State Faculty Stocks and Flows

	Without Early Retirement				With Early Retirement				
	Nontenure	Tenure 1*	Tenure 2**	New Appts.	Nontenure	Tenure 1*	Tenure 2**	New Appts.	Early Retirements
School of Humanities & Sciences	130	204	79	36	140	214	59	38	5
School of Engineering	46	69	32	13	50	74	23	14	2
Other Schools & Unaffiliated (excl.Med.)	56	95	34	16	61	99	25	17	3
	232	368	145	65	251	387	107	69	10
School of Medicine	87	106	62	24	95	112	48	26	5

* Tenured faculty less than 55 years old
** Tenured faculty between 55 and 64

Table 9. Steady-State Salary and Retirement Costs

(Note: All figures shown in thousands of 1971 dollars)

	Without Early Retirement	With Early Retirement		
	Salaries Plus 10% Retirement Contribution	Salaries Plus Ret.Contr.	Early Ret.Supplemts.	Total
School of Humanities & Sciences	8,198	8,104	199	8,303
School of Engineering	3,158	3,129	71	3,200
Other Schools & Unaffiliated (excl. Med.)	4,103	4,090	99	4,189
	15,459	15,323	369	15,692
School of Medicine	7,887	7,916	207	8,123

match salary costs with sources of funds; rather, the costs in columns 1 and 2 of Table 9, which include the 10% University contribution to TIAA-CREF, represent full-time salaries (on a 9-month basis for all Schools except Medicine) for all the regular faculty in a School.* For each of the early retirements indicated in the last column of Table 8, the expected value of the bonus paid by the University was computed. These quantities are aggregated for each School in the third column of Table 9.

These equilibrium results serve to indicate the directions in which changes will occur due to the new policy and, ultimately, the magnitude of these changes. With reference to Table 8, we observe the following effects in each School: (1) an 8 to 9 per cent increase in the nontenure component of the faculty, (2) a 35 to 50 per cent increase in the ratio of young (under 55) tenure faculty to old tenure faculty, and (3) a 5 to 8 per cent increase in the annual new appointment rate. In view of (3) we must conclude that early retirement policies are not a particularly effective means of increasing the flow rate of new appointments in the long run. Table 9 shows

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*Observe that we have chosen to ignore the costs of recruiting and hiring new faculty members in making our comparisons. Although an increase in new appointment rates will probably yield an increase in total hiring costs, this factor is so insignificant in comparison with salary costs that it does not appear to merit inclusion in the calculations.

that in all Schools except Medicine the annual salary cost decreases as the result of the substitution of nontenure and younger tenure faculty for older tenure faculty. Just the opposite occurs in the School of Medicine because the salaries that must be offered to attract new people there, even in nontenure positions, are considerably higher than those being paid to many of the older faculty. If one disregards the School of Medicine, faculty salaries combined with early retirement supplements of approximately $400,000 annually yield a total cost that is only 2 per cent greater than the status quo cost.

2. Short-Run Results

Five-year forecasts were made for each School under the alternatives of the status quo and implementation of the early retirement program in 1972. Starting with an estimated faculty distribution as of September 1, 1972, the model was used to project the numbers, flows, and costs of faculty through September 1, 1977. These short-run computations used the same assumptions as did the equilibrium ones discussed in the previous section. In addition, in estimating future costs it was assumed that average and median salaries increase at the rate of 4 per cent per annum. The results appear in Tables 10 through 19. Here again, in the first set of tables "New Appointments" and "Early Retirements" refer to flows into and out of the system during a year, and entries appearing

Table 10. Short-Run Faculty Stocks and Flows
School of Humanities and Sciences

	Without Early Retirement				With Early Retirement				
	New Appts.	Nontenure	Tenure 1*	Tenure 2**	Early Rets.	New Appts.	Nontenure	Tenure 1*	Tenure 2**
9/1/72	36	136	210	67	-	36	136	210	67
9/1/73	36	134	210	69	11	44	142	210	61
9/1/74	36	133	210	70	8	41	145	211	57
9/1/75	36	132	210	71	7	40	146	212	55
9/1/76	36	131	210	72	6	39	145	213	55
9/1/77	35	130	210	73	6	39	145	213	55
	—				—	—			
Five-year Total	179				38	203			

*Tenured faculty less than 55 years old
**Tenured faculty between 55 and 64

Table 11. Short-Run Faculty Stocks and Flows
School of Engineering

	Without Early Retirement				With Early Retirement				
	New Appts.	Nontenure	Tenure 1	Tenure 2	Early Rets.	New Appts.	Nontenure	Tenure 1	Tenure 2
9/1/72	9	32	95	20	-	9	32	95	20
9/1/73	9	33	93	21	2	11	35	93	19
9/1/74	10	33	90	24	2	11	36	90	21
9/1/75	10	34	87	26	2	12	38	87	22
9/1/76	10	34	84	29	2	12	39	85	23
9/1/77	10	35	82	30	2	12	40	83	24
Five-year Total	49				10	58			

Table 12. Short-Run Faculty Stocks and Flows
School of Medicine

	Without Early Retirement				With Early Retirement				
	New Appts.	Nontenure	Tenure 1	Tenure 2	Early Rets.	New Appts.	Nontenure	Tenure 1	Tenure 2
9/1/72	26	115	113	27	-	26	115	113	27
9/1/73	25	109	117	29	4	28	112	117	26
9/1/74	24	104	119	32	3	26	109	119	27
9/1/75	23	100	120	35	3	26	105	121	29
9/1/76	23	96	121	38	3	25	102	122	31
9/1/77	22	93	121	41	3	25	100	122	33
Five-year Total	117				16	130			

Table 13. Short-Run Faculty Stocks and Flows
Other Schools and Unaffiliated Faculty

	Without Early Retirement				With Early Retirement				
	New Appts.	Nontenure	Tenure 1	Tenure 2	Early Rets.	New Appts.	Nontenure	Tenure 1	Tenure 2
9/1/72	16	61	92	32	-	16	61	92	32
9/1/73	16	60	93	32	5	20	64	93	28
9/1/74	16	60	93	32	4	19	66	93	26
9/1/75	16	59	94	32	3	18	66	94	25
9/1/76	16	59	94	32	3	18	66	95	24
9/1/77	16	59	94	32	3	17	66	96	23
Five-year Total	80				18	92			

Table 14. Short-Run Faculty Stocks and Flows
All Faculty Except School of Medicine

	Without Early Retirement				With Early Retirement				
	New Appts.	Nontenure	Tenure 1	Tenure 2	Early Rets.	New Appts.	Nontenure	Tenure 1	Tenure 2
9/1/72	61	229	397	119	-	61	229	397	119
9/1/73	61	227	396	122	18	75	241	396	108
9/1/74	62	226	393	126	14	71	247	394	104
9/1/75	62	225	391	129	12	70	250	393	102
9/1/76	62	224	388	133	11	69	250	393	102
9/1/77	61	224	386	135	11	68	251	392	102
	—				—	—			
Five-year Total	308				66	353			

Table 15. Short-Run Salary and Retirement Costs
School of Humanities and Sciences

(Note: All figures shown in thousands of dollars)

	Without Early Retirement	With Early Retirement		
	Salaries Plus 10% Retirement Contribution	Salaries Plus Ret. Contr.	Early Ret. Supplements	Total
1972-73	8,415	8,415	-	8,472
1973-74	8,773	8,702	25	8,727
1974-75	9,144	9,028	45	9,073
1975-76	9,529	9,383	63	9,446
1976-77	9,928	9,763	80	9,843
1977-78	10,342	10,162	97	10,259
Five-year Total (Discounted @ 5%)	43,209	42,605	274	42,879

Table 16. Short-Run Salary and Retirement Costs
School of Engineering

(Note: All figures shown in thousands of dollars)

	Without Early Retirement	With Early Retirement		
	Salaries Plus 10% Retirement Contribution	Salaries Plus Ret.Contr.	Early Ret.Supplements	Total
1972-73	3,341	3,341	-	3,341
1973-74	3,490	3,478	4	3,482
1974-75	3,642	3,619	9	3,628
1975-76	3,797	3,764	14	3,778
1976-77	3,954	3,912	19	3,931
1977-78	4,115	4,065	25	4,090
Five-year Total (Discounted @ 5%)	17,204	17,062	62	17,124

Table 17. Short-Run Salary and Retirement Costs
School of Medicine

(Note: All figures shown in thousands of dollars)

	Without Early Retirement	With Early Retirement		
	Salaries* Plus 10% Retirement Contribution	Salaries* Plus Ret.Contr.	Early Ret.Supplements	Total
1972-73	7,991	7,991	-	7,991
1973-74	8,373	8,368	18	8,386
1974-75	8,762	8,753	33	8,786
1975-76	9,159	9,148	48	9,196
1976-77	9,564	9,551	64	9,615
1977-78	9,978	9,965	81	10,046
Five-year Total (Discounted @ 5%)	41,496	41,450	215	41,665

* All salaries are computed on an 11-month basis.

Table 18. Short-Run Salary and Retirement Costs
Other Schools & Unaffiliated Faculty

(Note: All figures shown in thousands of dollars)

	Without Early Retirement	With Early Retirement		
	Salaries Plus 10% Retirement Contribution	Salaries Plus Ret. Contr.	Early Ret. Supplements	Total
1972-73	4,237	4,237	-	4,237
1973-74	4,408	4,387	12	4,399
1974-75	4,585	4,551	22	4,573
1975-76	4,769	4,728	30	4,758
1976-77	4,962	4,918	38	4,956
1977-78	5,164	5,117	44	5,161
Five-year Total (Discounted @ 5%)	21,635	21,468	129	21,597

Table 19. Short-Run Salary and Retirement Costs
All Faculty Except School of Medicine

(Note: All figures shown in thousands of dollars)

	Without Early Retirement	With Early Retirement		
	Salaries Plus 10% Retirement Contribution	Salaries Plus Ret. Contr.	Early Ret. Supplements	Total
1972-73	15,993	15,993	-	15,993
1973-74	16,671	16,567	41	16,608
1974-75	17,371	17,198	76	17,274
1975-76	18,095	17,875	107	17,982
1976-77	18,844	18,593	137	18,730
1977-78	19,621	19,344	166	19,510
Five-year Total (Discounted @ 5%)	82,048	81,135	465	81,600

under "Nontenure", "Tenure 1", and "Tenure 2" are the numbers of faculty in those categories at the specified points in time.

The third column ("Early Retirement Supplements") in Tables 15-19 requires some additional explanation. The numbers of individuals retiring in a given year from each age and salary group were estimated by the flow model. For each such individual, the actual length of service distribution for the appropriate state was used to compute the expected early retirement bonus; these were then summed over individuals to yield the annual cost for the School. The annual cost figures for early retirement supplements assume the extra income granted to retirees is paid out of University operating funds over their remaining lifetimes, rather than as a lump-sum benefit upon retirement. Mortality rates were ignored in the five-year projections; that is, it was assumed all those who retired during the period would remain alive at least until the end of the period.

By funding early retirement supplements on an annual rather than a lump-sum basis, the University is able to reduce the first-year cost of the plan by an order of magnitude. In addition, with a steady flow of early retirements, it will take some ten years before annual commitments under this "pay-as-you-go" strategy will actually exceed what they would

have been under a lump-sum payment strategy. To illustrate, consider the following simplified (yet not unrealistic) numerical example. In 1972 and each year thereafter ten faculty members opt for early retirement. The University guarantees each of them a supplemental income of $4,000 per year. Suppose each individual is 60 years old when he retires. At the 1972 rate, an immediate whole-life annuity contract to provide $4,000 annual income can be purchased at age 60 from TIAA for approximately $42,700. Suppose further that each person lives for exactly 15 years after retirement. Table 20 shows the cash flow requirements for 20 years under each strategy.

Because of significant variations in the existing age distributions of faculty, the effects of the early retirement plan shown in Tables 10-19 differ in magnitude among the Schools. However, if we leave aside the School of Medicine for the present, certain generalizations can be made with regard to each of the other Schools:

(1) The number of faculty in nontenure positions will be 12 to 14 per cent greater at the end of the five-year period.

(2) This increase in nontenure faculty will be accompanied by a 25 to 45 per cent increase in the ratio of young (under 55) tenure faculty to old tenure faculty.

Table 20. Hypothetical Cash Flows for Early Retirement Program Under Alternative Methods of Funding

Year	Strategy A	Strategy B
1972	$427,000	$ 40,000
1973	427,000	80,000
1974	427,000	120,000
1975	427,000	160,000
1976	427,000	200,000
1977	427,000	240,000
1978	427,000	280,000
1979	427,000	320,000
1980	427,000	360,000
1981	427,000	400,000
1982	427,000	440,000
1983	427,000	480,000
1984	427,000	520,000
1985	427,000	560,000
1986	427,000	600,000
1987	427,000	600,000
1988	427,000	600,000
1989	427,000	600,000
1990	427,000	600,000
1991	427,000	600,000

Strategy A: Lump-sum Settlement With TIAA
Strategy B: Payment Directly by University

(3) There will be a 13 to 18 per cent increase in the number of vacancies for new faculty members over the five-year period. This significant increase in the short-run appointment rate is in contrast to the more modest one which obtains in equilibrium.

(4) The short-run cost of faculty salaries and retirement contributions may actually be less under the early retirement plan than under the status quo, even when the costs of early retirement supplements are included. According to our estimates in Table 19, the total discounted five-year cost for these Schools under the early retirement plan will fall one-half of one per cent short of its status quo value.

Once again, the School of Medicine proves to be a notable exception. Only minor changes occur in the composition of the faculty, while the cost of the early retirement program exceeds that of the status quo in every year. These effects can be explained by the special circumstances that prevail at that School. In the first place, it does not have a "tenure problem"; only 53 per cent of its faculty hold tenure positions at present as compared with 67 per cent

in Humanities and Sciences and 78 per cent in Engineering. Secondly, market conditions are such that new faculty members must be brought into the School at a salary level that is generally higher than that being paid to the older persons who would be encouraged to retire. In short, even when one takes into consideration the value of released faculty positions, implementation of the plan in the School of Medicine appears to yield a net cost to the University. Therefore, it is recommended that the Medical School faculty not be permitted to participate in the proposed early retirement program.

It should be emphasized that all of these computations assume the size of faculty is to remain fixed at the 1971 level in each School. If any School should wish to reduce its faculty, the early retirement plan can have an important effect on the speed with which this can be accomplished. Moreover, tc the extent that the older tenure group retains positions that are no longer needed in a School, the budgetary savings resulting from early retirements would obviously be much greater than we have estimated.